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Concerning the Problem of Analogic Reasoning in Ancient China

(Review Article*)

Probably all sinologists agree that reliance on analogy, whatever this may mean, constitutes one of the salient features of the philosophical thinking of the Chinese. On the other hand, the problem itself has so far not been investigated beyond a few occasional contributions¹, and even the very notion of analogy which is implied in statements about the 'analogical thinking' of the Chinese remains vague. Cikoski's original and stimulating paper is, in fact, the first attempt to deal more thoroughly with analogy and its role in Chinese thought of the Late Chou period, and as such it deserves careful attention. It is most unfortunate that the author's unconventional approach to the problem together with the unnecessarily involved presentation of his contentions make the paper hard reading and are likely to deter many sinologists from giving it the attention it deserves.

The paper has two different levels which should be clearly distinguished. The first of these, which I shall call methodological, is concerned with the author's own mathematical conception of analogy. The second is sinological in the sense that it is intended to constitute an application of the author's theoretical ideas to Chinese source materials. In my opinion, both these levels call for critical remarks.

Roughly one third of the paper deals with the author's conception of analogy, according to which a *concept* is "the sort of entity called Boolean algebra" (p. 355, footnote 2)² and an *analogy between concepts* is "a homomorphism between Boolean

* John S. Cikoski, *On Standards of Analogic Reasoning in the Late Chou*, "Journal of Chinese Philosophy" II/3, 1975; pp. 325-357.

¹ Cf., e.g., the chapter *Types of reasoning in Li Ssü* in D. Bodde, *China's First Unifier*, Leiden, 1938 (pp. 223-232); and D. C. Lau, *On Mencius' use of the method of analogy in argument*, "Asia Major" X/2, 1963, pp. 173-194.

² More specifically, Cikoski defines a *concept* as a system consisting of four elements: 0 (for false) and 1 (for true); a set of predicates; and "a set of axioms sufficient, given the arbitrarily set value of 0 or 1 for each individual predicate in

algebras" (ibid.). C i k o s k i also claims "to have demonstrated the mathematical possibility of a calculus of analogies quite independent of, and quite equivalent to, a calculus of propositions" (ibid.). As can be seen from these quotations, it would be better for the methodological part of the paper to be reviewed by a professional mathematician rather than a sinologist. It is only fair to emphasize that my remarks concerning the methodological level are merely those of a sinologist who cannot claim competence in what C i k o s k i calls "a rather abstruse and quite recently-developed branch of modern mathematics" (p. 351).

Obviously, analogy is a sort of similarity. The notion of analogy has already attracted the attention of mathematicians, and it is perhaps useful to start with what a contemporary mathematician has to say on the subject³. P o l y a writes: "The essential difference between analogy and other kinds of similarity lies ... in the intentions of the thinker. Similar objects agree with each other in some aspect. If you intend to reduce the aspect in which they agree to definite concepts, you regard those similar objects as analogous. If you succeed in getting down to clear concepts, you have clarified the analogy" (I, p. 13). Clearly, it is *clarified analogies* which are of special interest to the mathematician, and these are said to be of three sorts, namely, first, in the case of "systems of objects subject to the same fundamental laws (or axioms)"; second, in the case of *isomorphism*; and third, in that of *homomorphism*, this latter non-technically described as "a kind of systematically abridged translation" in which "subtleties may be lost" but in which, "on a reduced scale, the relations are preserved" (I, pp. 28-29). Nowhere does P o l y a indicate that the notion of analogy may be connected with that of Boolean algebra(s), and he certainly does not admit the idea of anything like a 'calculus of analogies'. His standpoint may be summarized in his own words: "I do not think that it is possible to explain the idea of analogy in completely definite terms of formal logic; ... analogy has to do with similarity *and* the intentions of the thinker. If you notice some similarity between

the concept, to determine whether their conjunction necessarily has the value zero" (pp. 325-326). Conjunctions which are necessarily false are *rejected* (*R*), and those which are not necessarily false are *permitted* (*P*). Axioms "need not be stated in the form of logical propositions" (p. 326): for each particular concept a complete table of *P* and *R* combinations of truth and falsity of all its predicates "specifies its axioms with mathematical exactness" (ibid.). For the sake of clarity, it should be added that the term *predicate* is used by the author for what are, in fact (cf. p. 337), declarative sentences "which may be true or false but not both simultaneously" (p. 325). It is perhaps worthy of note that such predicates and their sets spoken of in the definition are merely exemplified by a few self-evident cases (such as the concept of a warning light or that of a telephone-switchboard), and that no criteria of their selection for the construction of appropriate sets are explicitly stated by the author. This short account of one important point (actually the starting point) of C i k o s k i's considerations is also intended as an illustration of his approach to the problem of analogy in its entirety.

³ The quotations which follow are taken from G. P o l y a, *Mathematics and Plausible Reasoning*, I-II, Princeton University Press, 1954.

two objects (or, preferably, between two systems of objects) and intend to reduce this similarity to definite concepts, you think analogically" (II, p. 27).

In the light of what P o l y a says about analogy, the main novelty of C i k o s k i's paper appears to be twofold: first, his interpretation of concepts as Boolean algebras; and second, his major claim that he has found a calculus of analogies which is "an independent equivalent of propositional logic." It is also these two interconnected contentions which constitute the core of C i k o s k i's tentative theory and which underlie his method of dealing with Chinese materials in the sinological part of the paper. To my mind, all this, and in particular the major claim to have found a calculus of analogies, appears to be highly controversial.

Clearly, if the author's major contention is right, he has made an important discovery in the field of formal logic. The importance of such a discovery goes far beyond its possible applications to the problem of Chinese 'analogical thinking', and I think that the discovery itself together with a rigorous proof of it had better be presented in a special (and more systematic) paper destined for mathematicians and logicians rather than on the margin of a sinological contribution. Now, in the body of C i k o s k i's present paper there is hardly anything like a rigorous mathematical demonstration of his major claim. For my part, I am doubtful whether such a demonstration is possible, — even if the author's interpretation of *concepts* in terms of Boolean algebra be taken for granted. As for the interpretation itself, I consider it an interesting attempt to clarify what P o l y a rather vaguely calls 'definite concepts' to which analogy should be reduced, and I think that on this point C i k o s k i may be on the right track. However, he appears to assume (if I understand him correctly) that the very fact of interpreting concepts in terms of Boolean algebra together with that of interpreting analogies as cases of homomorphism between Boolean algebras necessarily leads to a 'calculus of analogies' which is "quite independent of, and quite equivalent to, a calculus of propositions." If so, he is perhaps mistaken. It is true that propositional calculus constitutes one of the interpretations of Boolean algebra, but this, to my knowledge, does not mean that Boolean algebra itself can replace propositional logic.

Parenthetically, it strikes me that the author — unlike contemporary logicians and historians of logic — uses the term 'propositional logic' in a sense which includes syllogistics; cf., for instance, "analogy and syllogism are but two sides of one coin" (p. 352, where in accordance with the context one would expect *argument from propositional logic* rather than *syllogism*). What is more, at the very beginning of the paper the author's statement to the effect that "propositional logic was developed in late Chou China to roughly the same state as it was in ancient Greece" (which statement itself is highly questionable, to say the least) is illustrated by a passage from the *Lü-shih Ch'un-ch'iu* (LSCC), which is labeled as an example of "the syllogism form" (p. 325)⁴.

⁴ Besides, I do not know how the author would press the Chinese example in question into a truly syllogistic form (whether Aristotelian or traditional) such

Furthermore, from the sinological point of view, it is important to note that it remains an open problem to what extent the analytical procedure which follows from Cikoski's theoretical contentions may be useful for a comprehensive analysis of Chinese 'analogical thinking.' Curiously enough, the author himself gives only one explicit example of the application of his method to a case of 'analogic reasoning' which is taken from the *LSCC* (pp. 342-344), and this is certainly too little to be a convincing test. Moreover, without entering into the details, suffice it to say that for the purposes of the author's own analysis of this particular example its original text had to be reformulated past recognition⁵, — so that one fails to see what the author actually means when he says that "an argument from analogic reasoning can be expressed in Classical Chinese with more facility and grace than can one from propositional logic" (p. 325). Clearly, all this calls for reconsideration on the part of the author himself. For my part, in the final section of the present article, I shall revert briefly to the problem of Chinese 'analogical thinking' in the light of my own suggestions.

Proceeding to the purely sinological level of Cikoski's paper, I wish to emphasize that it gives evidence of the author's wide reading in Late Chou literature. Actually, Cikoski gives — always in his own translation — an interesting collection of passages which he detected in Chinese texts and which he considers per-

as the example is claimed to represent. In fact, the example as it stands does not correspond to any syllogistic mood, and the author's inadvertent indication concerning the major and minor term (premiss?) only adds to the confusion. This, however, is a minor point.

⁵ This is not a surprising fact, since the necessity for such reformulations is inherent in the method itself and, in particular, is closely connected with the specific role of 'sets of predicates' as representing concepts. I think that the author has overlooked the difference between the *construction* of clearly defined concepts and the *reconstruction* of concepts which only underlie (or are assumed to underlie) particular contexts. It is clear that in such cases as that of "a warning light ... that goes on only when the engine oil pressure falls below a specified limit, provided the ignition is on" (p. 326) the relevant predicates are, in a sense, included in the very linguistic expression corresponding to the concept ('The warning light is on;' 'The ignition is on;' 'The oil pressure is above the limit;' cf. *ibid.*). However, if a sinologist wants to apply the same method to Chinese texts, he inevitably has to do with the reconstruction of underlying concepts and, in particular, of their relevant predicates. In such cases, as can be seen from the author's own example, 'sets of predicates' are to be intuitively apprehended from the intentions assumed to underlie the context rather than extracted from the surface level of the context. This, I think, is the reason why the author is silent on the problem of constructing his 'sets of predicates' (cf. *supra*, p. 64, footnote 2). I also think that the intuitional component inherent in the author's analytical procedure is, in fact, a necessary counterpart of 'the intentions of the thinker' which, as Polya indicates, are included in the very notion of analogy. Since such intentions together with the corresponding 'sets of predicates' merely underlie the context and are not explicitly stated by the Chinese thinker himself, they simply cannot be reconstructed without resorting to intuitive means.

tinent to analogy as it is expressed in Chinese and used by the Chinese. Understandably, in view of the fact that actually only one of the translated passages is meant to illustrate the author's analysis in terms of concepts and analogies as previously defined, all other translations are concerned with the author's minor contentions and corollary problems omitted from the methodological part and put forward as specifically sinological rather than general⁶. C i k o s k i cites a number of texts, such as *Mencius*, *Hsün Tzu*, *Han Fei Tzu*, etc. Most of his materials, however, are drawn from the *LSCC*, and it is perhaps one of the author's merits to have shown the importance of that text, so far rarely resorted to, for the investigation of specific aspects of Chinese 'analogical thinking.' I think that at least that part of the paper, which is more readily accessible to sinologists than the methodological one, should be taken into consideration by scholars working on Chinese thought.

This, of course, means neither that I entirely agree with the author's choice of items, nor that I consider his translations and/or interpretations always flawless. For instance, concerning the first point, I think that the lengthy (and questionable, for that matter) translations from the *Kung-sun Lung Tzu* had better be omitted for the simple reason that they are not pertinent to the author's main problem. The second point is more complex and would deserve a fuller technical discussion than is possible here.

I would make the general observation that C i k o s k i's translations tend to suffer from his curious disregard of the philological apparatus and technicalities which play such an enormous role in sinological research and indeed are the necessary prerequisite for it. Granting that adequate interpretation of Chinese texts is a substantial part of sinological research (and perhaps still more so in the case of such a sophisticated kind of research as that undertaken by the author), my general remark can be illustrated by two examples drawn from the paper.

On p. 349 C i k o s k i has a translation from the "An Szu" chapter of the *LSCC* X/3, which is rather important from his point of view since the passage is assumed to deal with "the explicitly stated consequences of a failure in analogic reasoning." Without entering into the details of his interpretation, suffice it to say that already in the 18th century such scholars as P i Y ū a n and L u W e n - c h ' a o considered the part of the Chinese text beginning with 故反以相非，反以相是⁷

⁶ In particular, the author is interested in such problems as: tentative identification of Chinese equivalents of specific terms used in his general theory (examples: 'predicate' is equated with *ts'u* 辭; 'axiom' with *tsé* 則; 'concept' with *chih* 指; *shih* 是 in one of its meanings is assumed to correspond to 'is congruent by at least one homomorphism to'); distinction of 'a natural analogy' as against 'a forced analogy'; homological (or analogical) categories in Chinese thinking; explicit warnings against failure to recognize analogies; practical aspects of Chinese analogic reasoning; etc.

⁷ In C i k o s k i's rendering: "Thus they [i.e. members of various *lei*] contradictorily are assumed to be isomorphic with each other, contradictorily are assumed

and corresponding to the last eleven lines of C i k o s k i's translation a misplaced text fragment which originally belonged to another chapter, "Pu Êrh" (LSCC XVII/7)⁸. Now, if P i Y ü a n and others are right (as I think they are), then the passage, as belonging to a different context, for this very reason cannot be interpreted as it is interpreted by C i k o s k i. Clearly, the author's silence on this matter means either that he is unaware of the textual problem implied in his translation, or that, aware of the problem though he is, he disagrees with P i Y ü a n. and thinks that the passage actually belongs to where it stands in the *textus receptus*. In the latter case, however, it would be more advantageous for the author to substantiate his opinion rather than give the impression that he considers the problem non-existent.

On p. 354 C i k o s k i cites a passage from the "Pieh Lei" chapter (LSCC XXV/2) in which we read: "Analogical categories definitely cannot be ascertained by [hypothetical] extension." This is a sophisticated and unlikely translation of the sentence which concludes a set of specific examples and which, in the Chinese original reads: 類固不必，可推知也⁹. Now, further on in the same chapter, after another set of examples, the Chinese text has: 物固不必，安可推也. C i k o s k i does not take into consideration this second passage, but T'a o H u n g - c h' i n g (1859-1917) noticed the parallelism between the two concluding sentences in both their syntactic structure and meaning. Concerning the second sentence, the same scholar equated the character 安 with 於是 (the equation as such being known at least since W a n g Y i n - c h' i h). Since the second sentence rather clearly means "From these [preceding examples] it can be inferred that things are inherently indeterminate," the first should read something like "It can be inferred [from the preceding examples] that categories are inherently indeterminate."

It is not my intention to predict to what extent C i k o s k i's contentions, whether general or sinological, will remain tenable in the light of closer inspection and further research, including, as I hope, the author's own. As has been indicated,

to be heteromorphic with each other." This is unacceptable for various reasons; however, even within the author's own assumptions I fail to see why the original order of phrases has been reversed in the translation and why *hsiang shih* is taken to mean 'to be isomorphic with each other' instead of '... homomorphic ...' (cf. supra, p. 67, footnote 6).

⁸ See H s ü W e i - y ü, *Lü-shih Ch'un-ch'iu chi-shih* (repr. Peking 1955); I, p. 411; and II, p. 803. Cf. also R. W i l h e l m, *Frühling und Herbst des Lü Bu We* (Jena 1928); p. 125 and footnote 26 on p. 487; p. 285.

⁹ As can easily be seen, C i k o s k i's rendering of the sentence conflicts with the punctuation as indicated in the quotation, — which punctuation is rather firmly established since T'a o H u n g - c h' i n g. Such is also the case with R. W i l h e l m (op. cit., p. 435) who rendered the same sentence as: "Daraus ersieht man, dass man von einer Art nicht sicher auf eine andere schliessen kann." It appears that both translators were misled by K a o Y u's paraphrase appended to the sentence in question. For both this point and further discussion, cf. H s ü W e i - y ü, op. cit.; II, p. 1134 and 1137.

the final judgment on the author's mathematical conception of analogy as put forward in the paper must belong to mathematicians rather than sinologists. From the sinological point of view, however, I think that what may safely be stated by now is this: the author is a pioneer in dealing with an important and somewhat neglected problem in an unprecedented way, and his paper is bound to stimulate research in the hardly explored field of Chinese 'analogical thinking.' This, I think, is the main merit of the paper as it stands.

It will not be out of place, I believe, to supplement the foregoing critical review of C i k o s k i's paper with a short (and necessarily sketchy) account of what I consider my own approach to the subject. Leaving aside the fact that, as a reviewer, I feel it my duty to respond in my own way to the stimulating paper under review, I hope that the presentation of a standpoint which is both different from and alternative to that of the author may be a contribution to a more comprehensive discussion of the problem in its entirety.

It is fair to say at the start that my general standpoint is rather conventional, in the sense that it is close to that of P o l y a. In particular, I share his opinions to the effect that analogy as such cannot be explained "in completely definite terms of formal logic" and that the notion of analogy implies "the intentions of the thinker" (which latter, let me add, may happen to be confused). Proceeding to the specific field of Chinese 'analogical thinking,' my first point is that in a host of cases we are faced with highly superficial analogies which — in contradistinction to P o l y a's notion of clarified analogy — might perhaps be termed *unclarifiable* (rather than unclarified), and which appear to be mere figures of speech rather than anything else. Analogies need not necessarily form argument-like chains. If they stand by themselves, as, for instance, in poetical imagery, they are to be considered stylistic devices of literary rather than philosophical interest. It should also be clear that in such cases any attempt at their analysis in terms of whatever logical calculus would be preposterous.

This, however, does not mean that even such cases of the simplest type of 'analogical thinking' lack specific structural features at the syntactic level. It is my firm conviction that the strong tendency among Chinese writers to resort to 'analogical thinking' is closely connected with the equally strong (or perhaps even stronger) tendency to exploit linguistic parallelism for which, as is known, Classical Chinese offers possibilities undreamt of by users of any other language¹⁰. This means that

¹⁰ Parallelism is, first of all, a stylistic device, but in Classical Chinese it has also acquired a specific grammatical significance and also has its share in the patterning of Chinese reasoning (including the logical sense of the latter term); cf. my *Notes on Early Chinese Logic (IV)*, RO XXVIII/2 (1965); pp. 87-111, and especially 104-105. On this occasion, it should also be remarked that the close connection between parallelism and analogy in Chinese is well matched by that between parallelism and antithesis — which latter itself is another typical feature of Chinese thinking and expression. Thus, both 'analogical thinking' and 'antithetical thinking' are, in a sense, linguistically-generated. The role of antithesis, however, lies beyond the scope of the present discussion.

even in cases of the simplest sort analogies usually are expressed by means of parallel syntactic structures. This important point can be best illustrated with an example going beyond the simplest cases and belonging to the class of argument-like chains of analogies.

Clearly, the higher the level of 'analogical thinking,' the more highly structured its linguistic expression and, in particular, its parallelism. This can easily be seen in the case of argument-like chains of analogies which, although they happen to be considered characteristic of Chinese logic, are in fact pseudo-logical constructions. One such example deserves to be cited and analyzed in some detail because of both its pseudo-logical function and the elaborate parallelism it displays.

The example is taken from the well-known memorial against the expulsion of aliens, submitted by L i S s u to the King of Ch'in; *Shih chi*, ch. 87¹¹. The Chinese text runs (of course, the arrangement in lines is mine, but it does not change anything in the original except for the omission of a two-character particle introductory to the entire passage):

- (1) 太山不讓土壤故能成其大
- (2) 河海不擇細流故能就其深

- (3) 王者不却衆庶故能明其德

Two important features of this text can immediately be seen even by those who are entirely ignorant of Chinese: the quantitative fact that all lines are of equal length, each of them being composed of eleven characters; and the qualitative fact that in four corresponding positions of all lines there are identical characters. This by itself strongly suggests that, first, the passage is a closely-knit piece of text, and second, that the three component parts of the piece follow the same structural pattern, that is, are parallel to each other. Actually, elementary parsing shows that each line is composed of: 1) a two-character subject (or 'topic'); 2) the particle *pu* negating the predicate which follows it; 3) a compound predicate composed of one-character verb plus its two-character object; 4) the particle *ku* introducing the second clause; 5) the verb *neng*; 6) its one-character verbal complement; and 7) a two-character object of the preceding verbal complement, with the possessive particle *ch'i* as its first member. This somewhat pedantic description of the pattern underlying the component parts of the original passage is not so useless as it perhaps might appear. It will allow me to substantiate a number of facts which I consider relevant to 'analogical thinking', and which deserve to be clearly stated before proceeding to the discussion of the logical aspects of this kind of thinking. Besides, it is perhaps worthy of note that so much can be said about the linguistic structure of the passage without even attempting to translate it. As a matter of fact, the foregoing description c o u l d

¹¹ For the Chinese text, see K'ai-ming shu-tien ed. of the *Êr-shih-wu shih*, p. 0215₂; Takigawa Kametarō, *Shiki kaishu kōshō* (repr. Peking 1955), vol. VIII, p. 3940.

have been produced by a hypothetical sinologist having sufficient experience in the analysis of Chinese texts, but unable to translate the passage in question merely because of his ignorance of what the expressions which stand for the unspecified subjects, verbs and objects actually mean.

Reverting to the main subject, it is precisely the foregoing description of the pattern recurring in all three lines which makes clearly visual the various aspects of extreme parallelism underlying the entire passage and binding it up into a whole. Not only are the corresponding syntactic units composing each line of the same quantitative 'size' (one-character unit to one-character unit, two-character one to two-character one), but also, qualitatively, the corresponding units perform the same syntactic function, that is, are bound up by syntactic relations of the same sort. This means that the parallelism is not only that of the units which correspond to each other in different lines. In fact, this parallelism includes the identity of syntactic relations which occur in each line, and it should be noted that this identity is matched by that of the corresponding semantic relations. Furthermore, the recurring pattern as it has just been described itself suggests that the piece of text under discussion is a case of 'analogical thinking.' I wonder what else — if not a chain of analogies — could possibly be expressed within such a structural framework as the one we are discussing.¹² Finally, it should be emphasized that all this is perfectly clear only in the Chinese original, while the entire quantitative aspect together with much of the qualitative one must inevitably disappear in translation. At this point, it is useful to compare the Chinese original with the following rendering of the passage:¹³

- (1) Mount T'ai does not reject the dust, and so is able to attain its greatness.
- (2) The Yellow River and the sea do not make preference between the tiny rivulets, and so are able to attain their deepness.

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- (3) A King does not repulse the masses of the people, and so is able to make his power illustrious.

Obviously, the analogies put forward in the passage under discussion are of a poetical-emotional rather than factual quality, and I think that any attempt at their clarification (in P o l y a 's sense of the term) would be a waste of time. The very heterogeneity of such objects as Mount T'ai and the Yellow River together with the sea on the one hand, and a King on the other, itself shows the futility of

¹² Of course, I do not want to imply that any parallelistic pattern necessarily suggests 'analogical thinking.' As has been indicated, parallelism is also closely connected with Chinese 'antithetical thinking,' and there are parallelistic patterns which are suitable for both. I only mean that some patterns, like the one now in question, are specially suitable for the expression of analogies rather than of anything else.

¹³ Except for the arrangement and a few insignificant omissions, I follow D. B o d d e's translation, *China's First Unifier*, p. 20 and 228.

any attempt to reduce the analogies in question to anything like clear concepts, homomorphisms, etc.

The fact remains that the chain of these analogies, superficial and unclarified though they are, was considered an argument in its own right, that is, in particular, (1)–(2) were put forward as 'premisses' and (3) as a 'conclusion' allegedly following from (1)–(2). The passage as it stands itself strongly suggests such an interpretation, and the author's intentions to the same effect are perfectly clear in the light of the entire context of his memorial.

Now, it should be emphasized that the specific features of the passage which perhaps make it look like an argument are entirely irrelevant from the logical point of view, and that the passage in fact does not represent any logical argument at all. Assigning anything like logical validity to the sequence of analogies (1)–(2)/(3) would amount to claiming that a tripartite sequence of the recurring syntactic form like '... $\left\{ \begin{array}{l} \text{does} \\ \text{do} \end{array} \right\}$ not reject ..., and so $\left\{ \begin{array}{l} \text{is} \\ \text{are} \end{array} \right\}$ able to attain $\left\{ \begin{array}{l} \text{his, her,} \\ \text{its, their} \end{array} \right\}$...', should be considered a logically valid rule of inference¹⁴.

The case just discussed, somewhat extreme though it is, is rather typical of Chinese 'analogical thinking' and I believe that its analysis has revealed at least some of the most essential (although not necessarily desirable) aspects of this kind of thinking. In particular, I believe that I have illustrated two important points, namely, first, the close relationship between 'analogical thinking' and the specific structural and/or stylistic features of Chinese; and second, the pseudo-logical role this kind of thinking is likely to play at various levels of intellectual activity. It is true that the class of what I have called argument-like cases covers a variety of sub-types which do not exactly correspond to that exemplified by the case discussed. It also happens that an argumentation (or discussion) centered around analogy, in spite of its lack of logical validity, is not entirely pointless since it tends to elucidate a particular philosophical standpoint¹⁵.

A systematic investigation of the various ways in which analogy was used by Chinese thinkers has so far not been attempted by anybody. However, it may safely be assumed that the main conclusions drawn from the example just discussed hold good for the whole class of argument-like cases. Concerning the pseudo-logical role of such instances, one more generalization imposes itself, namely, that the formulation of a more or less plausible analogy was considered the final proof of the point in question (or the solution of the problem under discussion). It is precisely

¹⁴ It is true that according to Chinese criteria the passage constitutes a highly persuasive appeal to the King for the abrogation of his decree ordering the expulsion of aliens (cf. (3) as allegedly following from (1)–(2)). However, the persuasive qualities of the chain (1)–(2)/(3), whatever they may be, certainly are of extralogical character on which there is no need to dwell.

¹⁵ Cf., for instance, D. C. Lau, *op. cit.*, pp. 173–177, for the penetrating analysis of the debate on human nature in *Mencius*, VI/1, i–ii.

this pseudo-logical aspect of 'analogical thinking' rather than anything else which caused a contemporary Chinese philosopher to state that "the Chinese use analogy instead of inference" and that the Chinese type of argument "may be called the 'logic of analogy'"¹⁶.

Significant though Chang Tung-sun's opinion is in its emphasis on 'analogical thinking' (or rather one particular aspect of it), this opinion is not entirely to the point since it tends to ignore other aspects of Chinese thought, including such as are connected with the use of analogy. One such problem must be mentioned here, since it is preliminary for the identification of a specific class of cases connected with 'analogical thinking', of which the Chinese scholar was entirely unaware and which has so far not been referred to. Now, Chang Tung-sun suggests that argumentation in the logical sense of the term (that is, what he would call the 'Western logic of inference') is entirely absent from traditional Chinese thought, — and this is certainly misleading. Whatever may be the actual role of extralogical and/or paralogical factors in traditional Chinese thinking, it is beyond doubt true that early Chinese thinkers were also able to reason in accordance with logically valid patterns, and that they resorted to such, sometimes very complicated, forms of logical reasoning on various occasions. In particular, some of the Chinese thinkers were skilful users of logical patterns belonging to what is now called the calculus of functions (including two-place functions, that is, relations). It also deserves mention that the use of such forms of logical reasoning was greatly facilitated by specific 'calculational qualities' of the Chinese language.

Obviously, the problem of Chinese reasoning in the logical sense of the term is of prime importance in itself; what matters here, however, is its connection with the problem of 'analogical thinking.' In view of the strong Chinese tendency to resort to analogies, it is understandable that 'analogical thinking,' independently of both its literary role and pseudo-logical function as previously described, should also have its share in what actually constitutes Chinese logical reasoning. In fact, there are in early Chinese texts instances of reasoning which are logically valid (in the sense that they are reducible to inferential patterns corresponding to logical tautologies) and which at the same time display features typical of 'analogical thinking.' It appears that such instances are much less frequent than those previously spoken of; however, they deserve to be singled out as a separate class. I think that it is precisely this class of cases pertaining to 'analogical thinking' which is of special interest to students of the logical aspects of traditional Chinese thought. I also think that it would be better to restrict the use of the term 'analogic reasoning' to the class now in question.

It goes without saying that instances of 'analogic reasoning' thus conceived, that is, arguments (not argument-like strings of sentences!) in which some sort of

¹⁶ Chang Tung-sun, *A Chinese Philosopher's Theory of Knowledge*, repr. in "ETC., A Review of General Semantics" IX/3, 1952; pp. 203-226 (especially 220-221).

'analogical thinking' does actually coincide with logical validity of the argumentation, can by definition be subjected to analysis in terms of formal logic. What is perhaps less clear at the first sight is the fact that features arising from 'analogical thinking,' which by definition are present in such instances, are (and must necessarily be) subordinate to the logical structure of the argument. Obviously, what gives an argument its logical validity is its logical structure as based on an underlying logical tautology, while the presence or absence of features typical of 'analogical thinking' is, in fact, logically irrelevant.

It follows from all this that such cases as those just spoken of are to be analysed simply in terms of the appropriate logical calculus, and in particular, in terms of the calculus of relations which appears to be a fully sufficient means for the purpose. The exemplification of this important point would go beyond the scope of the present account and, consequently, must be postponed to another place. For the time being, I think it convenient to refer to a previous paper in which I analysed at length a highly elaborate argument taken from the *Mo Tzu*¹⁷. It is true that the argument was selected for analysis because of its complexity and the evidence it gives of the specific suitability of Classical Chinese for arguments pertaining to the calculus of functions (and relations) rather than because of anything else. However, it can easily be seen that the argument actually has some connection with 'analogical thinking' (and also with 'antithetical thinking'), and thus its logical analysis as has been put forward in the paper can give an idea of what I consider the analytical procedure to be applied to such arguments as are more specifically related to analogy.

Obviously the tentative tripartite classification of cases pertaining to Chinese 'analogical thinking' which emerges from the foregoing remarks leaves no room for anything like 'the logic of analogy' or 'the calculus of analogies.' Cases of the first sort, the purely literary ones, are simply a-logical (in the sense that they fall outside the scope of logical evaluation just as our 'figures of speech' do), while those of the second sort, the pseudo-logical ones, are by definition unsound from the logical point of view (whatever may be their persuasive power)¹⁸. On the other hand,

¹⁷ I mean the paper already referred to supra, p. 69, footnote 10; cf. pp. 88–101 for the logical analysis of the argument, and pp. 109–111 for the close correspondence between the linguistic form of the argument and its logical structure. — Examples of actual arguments which are more clearly related to 'analogical thinking' than the one just referred to will be discussed in a later section of my *Notes on Early Chinese Logic* (the one concerned with arguments formalizable within the calculus of relations).

¹⁸ As has been indicated, this second sort is rather composite since it embraces such cases as those ranging from paralogical argument-like chains of analogies (like that analysed at length in this paper) on the one hand, to philosophical discussions centered around analogies (like those investigated by D. C. Lau) on the other. It appears that the entire group of cases now in question deserves closer inspection which may also reveal further subtypes. It has also been indicated that cases pertaining to this sort need not be entirely pointless (Lau); however, I think that even in such cases the pseudo-logical use of analogy as replacing logical argument is

in cases of the third sort, that is, those which derive in some way from 'analogical thinking' and which at the same time are instances of logically valid arguments, the underlying analogical component is irrelevant to the inferential pattern itself — which pattern can be made clear and shown to be valid without resorting to anything like an unusual logical calculus.

All this does not mean that analogy as such is useless for rational thinking. This only means, first, that the actual role of analogy is quite different from that of formal logic; and second, that traditional Chinese thinkers failed to make good use of their 'analogical thinking' by resorting to it as a quasi-logical device.

The actual role of analogy in rational thinking is heuristic, in the sense that analogy is bound to suggest or stimulate hypotheses which, on verification, may lead to discoveries. Owing to this heuristic value, analogy may be compared to such intellectual operations as *generalization* on the one hand and *specialization* on the other; as a contemporary mathematician puts it, all three are "great sources of discovery" (Polya, op. cit., I, p. 12), and they "often concur in solving mathematical problems" (ibid., p. 15). It is also worthy of note that the same author specially emphasizes the role of analogy while he says that "Analogy seems to have a share in all discoveries, but in some it has the lion's share" (ibid. p. 17).

Obviously, Polya is concerned with mathematics (and possibly such sciences as are closely related to it) rather than human sciences and philosophy, — not to speak of Chinese philosophy. Thus, from our point of view which is both humanistic and sinological, it is more important to cite the opinion on the subject arrived at by a contemporary student of economical and social aspects of pre-modern Chinese history. R. Hartwell writes: "Inference by analogy, ... is useful in suggesting hypotheses, ... but the formulation of such hypotheses and their arrangement in an explanatory system is an independent intellectual process. The Chinese never developed the habit of framing generalizations in a hypothetical-deductive form." Further on the author states: "The Chinese did not normally distinguish differences between the relative worth of alternative modes of logical presentation."¹⁹

Both Hartwell's point of departure and his materials, and the specific ends of his study as well, are different from those of the writers who so far have been dealing with Chinese 'analogical thinking' (including those of the present writer), and this, I think, makes his considerate judgment the more important.

sufficiently clear. This amounts to saying that Chinese thinkers — even those who give evidence of being able to reason in accordance with valid and complicated logical patterns — appear to have been ignorant of the fact that comparison is not necessarily reason ("comparaison n'est pas raison"), or that, as the author of the *Junius Letters* puts it, "Comparisons may sometimes illustrate, but prove nothing."

¹⁹ R. M. Hartwell, *Historical Analogism, Public Policy, and Social Science in Eleventh- and Twelfth-Century China*, "American Historical Review" 76 (1971), pp. 690-727; see p. 722 and 725. — I wish to acknowledge my indebtedness to Professor D. Bodde for drawing my attention to this important paper.

In particular, I believe that Hartwell's remarks adequately point to the main aspect of Chinese 'analogical thinking', that is, the failure of the Chinese to exploit analogy in its actual, i.e., heuristic role. From my own point of view, one minor question remains open, namely, whether those cases in which the analogical component is subordinate to the logical form of the argument should not be considered a rudimentary step toward a more rational use of 'analogical thinking', one which is more in line with the heuristic role of analogy.